K-Jet Control Pressure

Welcome to Driveability Clinic.

Starting this month, our new department will concentrate on common driveability problems on a specific vehicle or type of fuel system. Unlike past overview articles, we'll limit each article in this series to a specific problem, subsystem, or procedure which can cause all those crazy no-starts, hiccups, stumbles, and blind staggers.

This month's first edition of Driveability Clinic will set the general format for the series. It will present the information about K- and K-Lambda cold enrichment in the following steps:

1) A system overview illustrating how the pieces of the cold enrichment subsystem interact.

2) Photos showing individual components and the internal hardware which makes them work.

3) Specific test procedures.

4) Tips on how to diagnose these systems. Whenever possible, we'll also include a list of common problems to help you shortcut diagnosis.

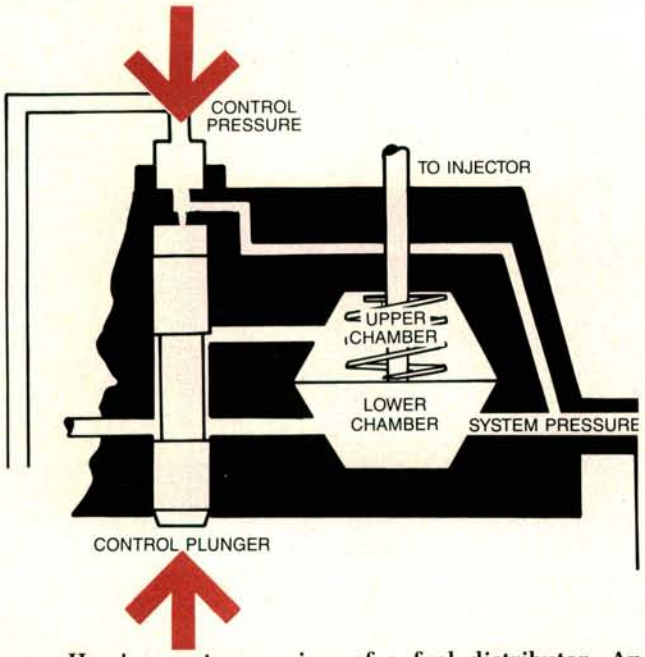
Three Important Pressures

One of the least electrical of all fuel injection systems used on imports is the Bosch K-Jetronic constant injection system. The only wiring in the original system was used to fire the cold start injector, and provide current to the resistance heater coil in the control pressure regulator. We'll look at these in a moment.

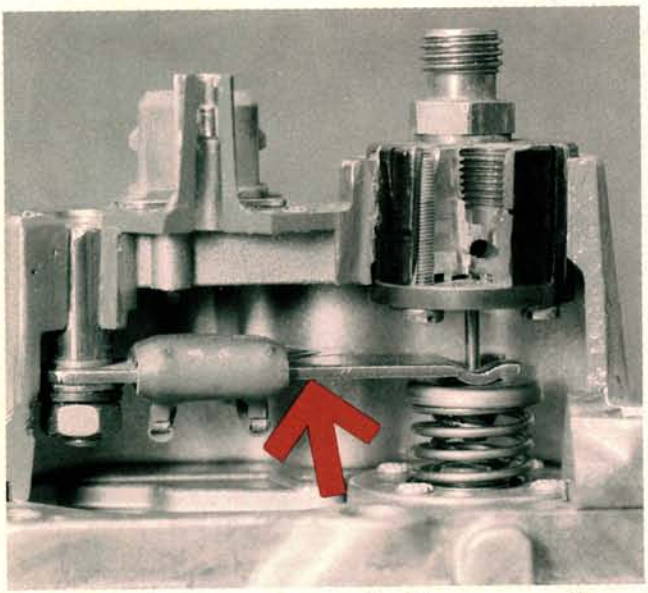
We ought to mention that there are three separate fuel pressures to be measured in this system:

- Main (or system) Pressure is the amount of regulated pressure delivered to the fuel distributor by the fuel pump.
- Residual Pressure is the amount of pressure trapped in the system after the pump shuts off. Residual pressure is important for quick restarts of the engine. It also helps to eliminate fuel percolation at high temperatures.
- Control Pressure—This is our spotlighted performer in this first installment of Driveability Clinic. We'll show how control pressure is vented away from the fuel distributor control plunger to provide warm up enrichment for a cold engine.

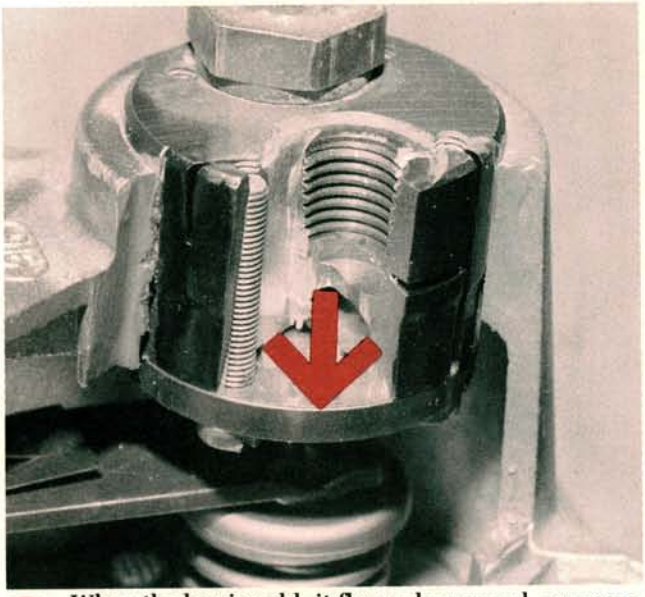
K-Jet Control Pressure



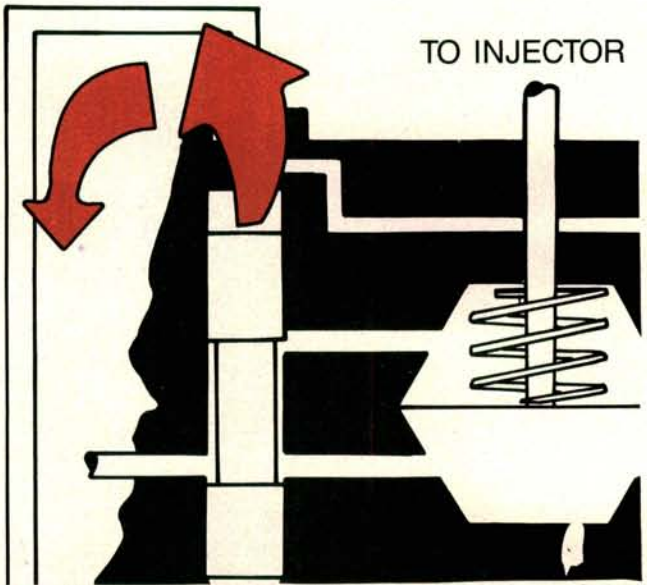
1 Here's a cutaway view of a fuel distributor. An internal passage allows system pressure to reach a chamber above the control plunger. This pressure pushes the plunger down in its bore. The greater the pressure above the plunger, the more vacuum it takes to lift the sensor plate. Less pressure above the plunger makes it easier for the sensor arm to lift the plunger. The same amount of vacuum at the sensor plate lifts the plunger higher, richening the mixture. And a cold engine needs more fuel.



2 Control pressure is controlled by the control pressure regulator (big surprise), which is shown in our photo. It acts as a temperature controlled valve to vent some of that system pressure away from the head of the control plunger when the engine is cold. This vented fuel pressure is returned to the fuel tank through a fuel return line. The flat bar (arrow) with the two wires attached to it is a resistance heater similar to a carburetor choke element. One end of the bar is bolted to a mounting stud in the regulator body. The other end is attached to a pivot cap and pin.



3 When the bar is cold, it flexes downward, overcoming the spring pressure below the arm. The pivot cap and pin move AWAY from the thin diaphragm shown in our (arrow) photo. With the fuel pump running, system pressure passes through the internal drilling in the fuel distributor. Then it exits from the line running to the control pressure regulator. Without the pin pushing on the diaphragm, fuel pressure pushes the diaphragm away from the ports in the regulator, allowing fuel to pass through the regulator.



4 Some of the pressure above the plunger is now being vented through the control pressure regulator, and returning to the fuel tank. Since there's less pressure pushing down on the plunger now, the same amount of vacuum at the sensor plate will lift the control plunger even higher. This delivers more fuel to the injectors, richening the mixture to our cold engine. In this respect, the control pressure regulator acts as a choke does on a carburetor. As the engine warms, however, the control regulator must stop venting system pressure.

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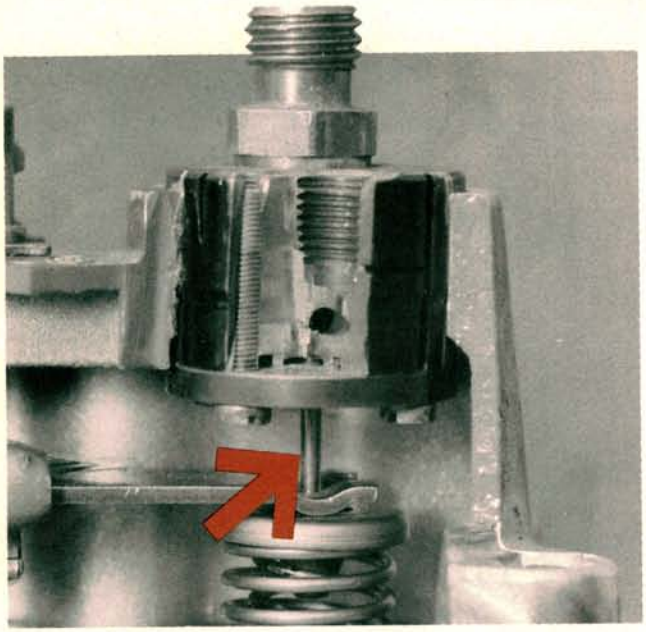
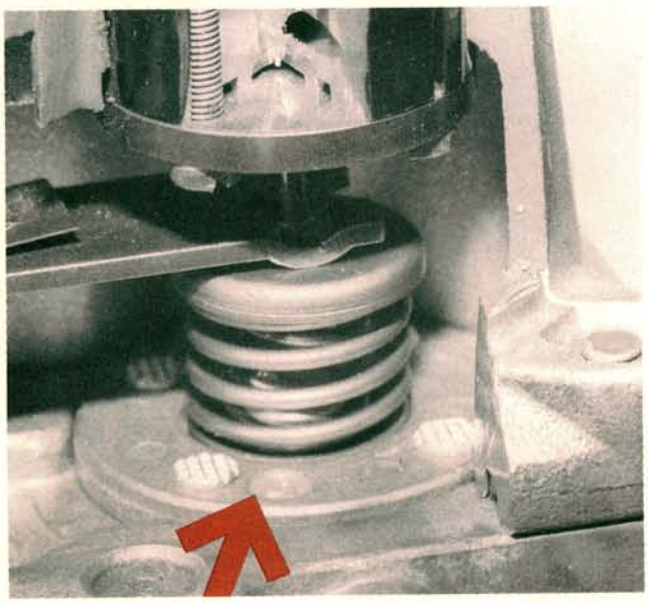


5 As the bi-metal bar in the regulator warms, it moves toward the diaphragm. The small pin (arrow) presses against the diaphragm, overcoming system pressure. The pin gradually pushes against the diaphragm shutting off the fuel flow through the regulator, back to the fuel tank. The amount of system pressure above the control plunger rises. Now there's a lot more pressure pushing back against the control plunger. With the same vacuum at the sensor arm, the plunger doesn't move as far, leaning the fuel mixture for warm operation.



6 Some control regulators have a bellows (arrow) below the return spring for the bimetal arm. The bellows move up and down in response to changes in atmospheric pressure at different altitudes. The bellows can also be connected to engine vacuum and act as a load sensor. Vacuum applied below the bellows reduces the spring tension pushing on the bi-metal arm. This lowers control pressure, and richens the mixture. Check your application, and use a vacuum pump to check bellows operation. And don't forget to check the vacuum source.

Control Pressure Quick Tips

• It's a good idea to check main system pressure too, especially if both cold and warm control pressure readings are low. Improperly adjusted system pressure, a weak fuel pump, a clogged fuel filter, or any restriction in the fuel supply to the fuel distributor can reduce pressures. A less likely possibility is that the internal drilling in the fuel distributor is plugged.

• If control pressure starts out low, and stays that way, or rises only slightly, the bimetal heating coil may not be getting hot. Unplug the electrical connector from the regulator and make sure there's at least 11.5 volts across the terminals when the engine's running. Also check the resistance of the resistor on the bi-metal strip. Look for about 20 ohms.

• If the car starts but stalls when cold, you know the cold start injector is not your problem. Remember that the cold start injector fires raw fuel into the intake plenum as long as it receives cranking voltage from the starter circuit and a ground provided by a cold thermo time switch. As soon as you stop cranking, the injector stops firing. If control pressure is too high, a cold engine starves for fuel as soon as the injector shuts off.

• Don't forget the auxiliary air regulator if you have no fast idle when the engine is cold. While the control pressure regulator provides added enrichment, it's the auxiliary regulator's job to provide fast idle by providing an air bypass around the throttle plate when the engine is cold.

• In addition to control pressure tests, make sure you eliminate any vacuum leaks both above and below the throttle plate. A tight vacuum system is vital to proper sensor plate movement.

• Higher than normal control pressures can be caused by any restriction in the control pressure circuit. A pinched line or a pocket of rust or dirt anywhere between the chamber above the control plunger and the return to the fuel tank can cause permanently high control pressure.

• Early and late style systems vented return pressure to the fuel tank differently. Systems before 1978 did not have a separate check valve in the fuel return line. The diaphragm in the control pressure regulator WAS the shut off. This system didn't work very well, and systems after 1978 added a separate check valve in the main system pressure regulator.

• What you can and cannot do to adjust control pressure is a matter of discretion, and of course, an important consideration when exhaust emissions become a factor. Many shops told us that they have "tweaked" control pressure by hitting the head of the bimetal spring's pivot stud with a punch and hammer, lowering cold control pressure. In some cases, a lowering of control pressure by as little as 0.1 BAR has eliminated a cold hesitation.

But be warned that this can also affect WARM emission readings in many cases. The EPA frowns on this. In many cases, a new regulator may be your only "legal" fix.

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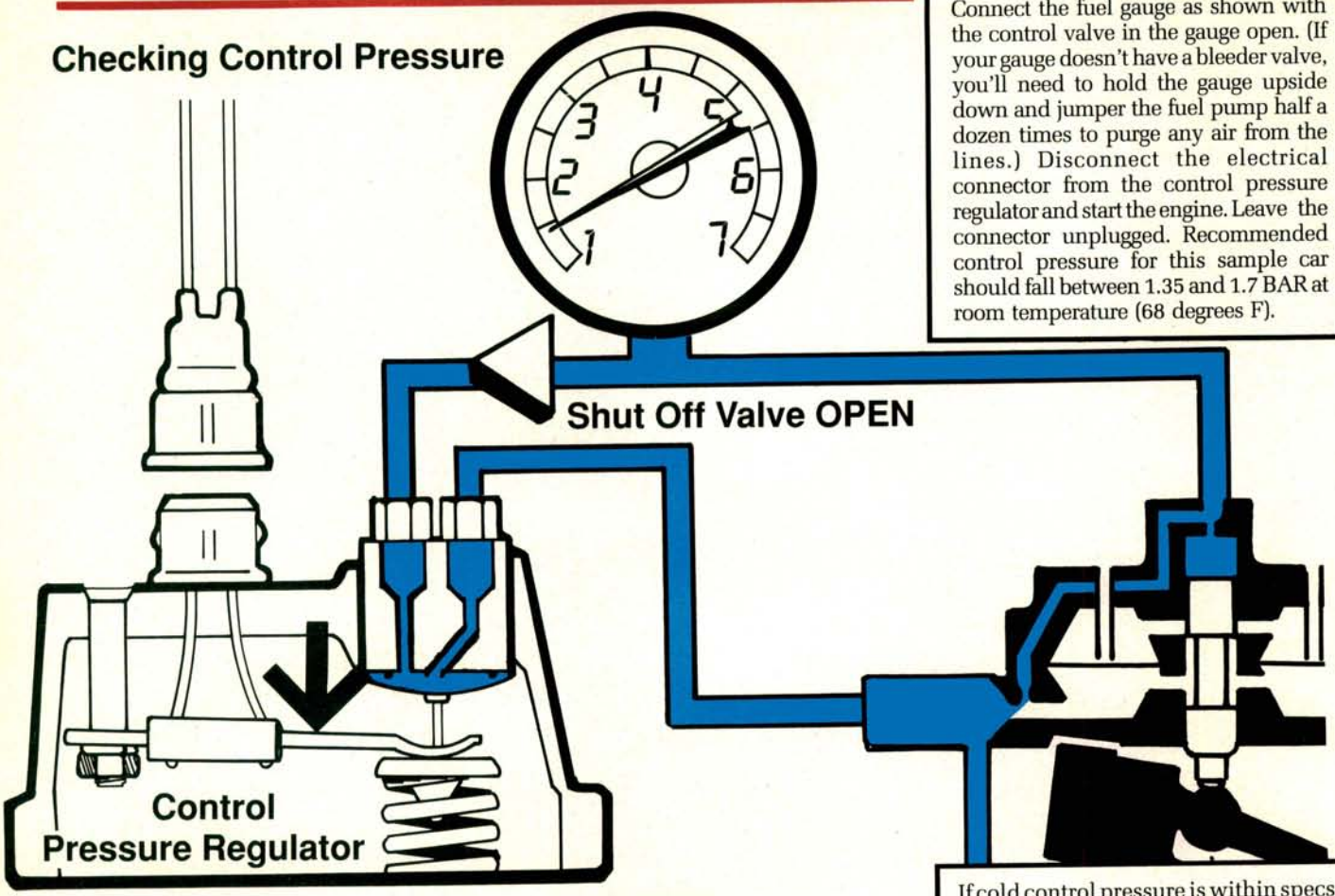
Checking Control Pressure

Connect the fuel gauge as shown with the control valve in the gauge open. (If your gauge doesn't have a bleeder valve, you'll need to hold the gauge upside down and jumper the fuel pump half a dozen times to purge any air from the lines.) Disconnect the electrical connector from the control pressure regulator and start the engine. Leave the connector unplugged. Recommended control pressure for this sample car should fall between 1.35 and 1.7 BAR at room temperature (68 degrees F).



If cold control pressure is within specs, reconnect the plug at the regulator. Leave the gauge valve in the open position. Control pressure should rise slowly as the bi-metal spring in the regulator warms. Note that our illustration shows the thin metal diaphragm in the regulator blocking the flow of fuel to the return line. As control pressure rises, it pushes down with more counter pressure against the head of the control plunger, leaning the mixture.

Current To Resistor